WHAT IS CLAIMED IS:

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~~1.~~ A method of operating a liquid feed fuel cell, comprising adding a quantity of perfluorooctanesulfonic acid to a fuel of the fuel cell.

2. The method of claim 1, wherein said perfluorooctanesulfonic acid is provided with a concentration of at least 0.0001 M.

3. The method of claim 2, wherein said perfluorooctanesulfonic acid is in the range of 0.0001 M to 0.01 Molar.

~~4.~~ An aqueous organic fuel-feed fuel cell, comprising:

a first electrode having a first polarity;

a second electrode having a second polarity different than the first polarity;

an electrolyte, comprising a proton-conducting membrane which is coupled to both said first and second electrodes; and

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a circulating system, operating to circulate a first liquid organic fuel which is substantially free of acid-containing electrolytes into an area of said first electrode to cause a potential difference between said first and second

electrodes when a second component is in an area of said second electrode;

wherein said first electrode is formed of a porous material configured in a way to be wet by the organic fuel.

5. A fuel cell as in claim 4, wherein said first electrode includes an additive which increases wetting properties by decreasing interfacial tension of an interface between the liquid organic fuel and a catalyst on the first electrode.

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6. A method of operating a fuel cell, comprising:

preparing a first electrode to operate as a first polarity electrode, said first electrode having a first surface exposed to the fuel;

circulating an organic fuel which is substantially free of any acid electrolyte into contact with said first surface of said first electrode, said organic fuel having a component which is capable of electro-oxidation;

preparing a second electrode which operates as a second polarity electrode, said second polarity being different than the first polarity, said second electrode having a second surface;

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preparing an electrolyte which includes a proton conducting membrane;

circulating a second reactive component into contact with said second surface of said second electrode, said second reactive component including a component capable of electro-reduction; and

coupling an electrical load between said first electrode and said second electrode, to receive a flow of electrons caused by a potential difference between said first and second electrodes.

7. A method as in claim 6, wherein said organic fuel includes a methanol derivative and water and is substantially free of any acid component.

8. A fuel cell as in claim 4, wherein said first electrode has a surface which is formed with high surface-area particles, said particles formed of alloys including at least two different kinds of metals.

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9. A fuel cell as in claim 8, wherein one of said metals of said alloy is platinum.

10. A fuel cell as in claim 9, wherein said alloy is formed of platinum-ruthenium, with a composition varying from 5 to 90 atom % of platinum.

11. A fuel cell as in claim 10, wherein said alloy particles are unsupported.

12. A fuel cell as in claim 8 further comprising a high-surface area carbon material for supporting said alloy particles.

13. An organic fuel cell, comprising:

a first chamber;

an anode electrode, formed in said first chamber, and including a first surface exposed to said first chamber, at least said first surface including an electrocatalyst and a wetting agent thereon;

an electrolyte, operatively associated with said anode electrode in a way to allow proton-containing materials to pass from said anode into said electrolyte, said electrolyte comprising a proton conducting membrane; and

a cathode electrode, operatively associated with said electrolyte, and having a second operative surface.

14. A fuel cell as in claim 13, wherein said second operative surface of said cathode electrode includes particles of electrocatalyst material thereon.

15. A fuel cell as in claim 14, wherein said electrocatalyst materials are materials optimized for electro-oxidation of a desired organic fuel.

16. A fuel cell as in claim 15, wherein said fuel is an aqueous methanol derivative which is free of acid component and said electrocatalyst is platinum-ruthenium.

17. A fuel cell as in claim 14, wherein said particles of electrocatalyst on said cathode are optimized for gas diffusion.

18. A fuel cell as in claim 17, wherein said particles include an electrocatalyst alloy mixed with a teflon additive.

19. A fuel cell as in claim 17, wherein said particles include an electrocatalyst mixed with said wetting agent which is an additive to promote hydrophobicity. 112 ¶1

20. A fuel cell as in claim 14, further comprising a pumping element operating to circulate said organic fuel past said anode electrode.

21. A fuel cell apparatus, comprising:

a first chamber having surfaces for containing an organic aqueous fuel therein;

an anode structure, having a first surface in contact with said first chamber, said anode structure being porous and capable of wetting the liquid fuel and also having electronic and ionic conductivity;

an electrolyte, in contact with said anode structure, said electrolyte formed of a proton-conducting membrane;

a cathode, in contact with said electrolyte in a way to receive protons which are produced by said anode structure, conducted through said electrolyte to said cathode; and

a second chamber, holding said cathode, said second chamber including a second material including a reducible component therein.

22. A fuel cell as in claim 21, wherein said anode is formed of carbon paper with an electrocatalyst thereon.

23. A fuel cell as in claim 21, wherein said anode includes a hydrophilic proton conducting additive.

24. A fuel cell as in claim 22, wherein said electrocatalyst layer and said carbon support are impregnated with a hydrophilic proton conducting polymer additive.

25. A fuel cell as in claim 23, wherein said polymer additive is formed of substantially the same material as the material of the electrolyte.

26. A fuel cell as in claim 21, wherein said anode is impregnated with an ionomeric additive.

27. A method of forming an anode with an ionomeric additive, comprising:

preparing an electrode structure having a high surface area;

impregnating the high surface area electrode structure with an electrocatalyst and binding said electrocatalyst thereto;

immersing the electrocatalyst-impregnated particles on said electrode structure into a solution containing an ionomeric additive;

removing said electrode structure from said solution, and drying said electrode structure; and

repeating said impregnating, removing and drying step until a desired composition electrode structure is obtained.

28. A method as in claim 27, wherein said electrocatalyst is bound in a polytetraflouroethylene binder.

29. A method as in claim 27, wherein said ionomeric additive is a Nafion™-type material.

30. A method as in claim 27, wherein said impregnating comprises mixing electrocatalyst particles with a binder and applying said binder/electrocatalyst onto a backing to form a thin layer of greater than substantially 200 meters squared per gram.

31. A fuel cell comprising:

a first chamber;

an anode electrode, formed in said first chamber, and including a surface exposed to said first chamber, at least said surface including an electrocatalyst material thereon, and including a hydrophobicity additive thereon;

an electrolyte operatively associated with said anode in a way to allow proton-containing materials to pass from said anode into said electrolyte, said electrolyte comprising a proton-conducting membrane; and

a cathode electrode, operatively associated with said electrolyte, to receive said protons from said membrane.

32. An aqueous fuel cell, comprising:

a first electrode operating as an anode, said first electrode being effective to catalyze an oxidation reaction of a non-acidic component;

a second electrode, operating as a cathode to undergo a reduction reaction of a non-acidic component;

a circulating system, operating to circulate a first organic fuel in an area of said anode; and

an electrolyte, comprising a proton conducting membrane ionically coupled with both said first and second electrodes, to pass ions therebetween.

33. A fuel cell as in claim 32, wherein said first electrode includes a hydrophilic proton conducting additive.

34. A method as in claim 6, wherein said preparing includes adding a hydrophilic proton conducting additive to said anode.

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35. An organic fuel cell, comprising:

a first chamber;

an anode electrode, formed in said first chamber, to have a surface exposed to said first chamber, at least said surface

including particles of a material thereon which catalyzes said anode to react with non-acid containing organic fuels;

an electrolyte operatively associated with said anode in a way to allow proton-containing materials to pass from said anode into said electrolyte, said electrolyte comprising a hydrogen ion conducting membrane; and

a cathode electrode, operatively associated with said membrane, to receive said ions from said membrane and to react with a specified material.

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36. A fuel cell as in claim 36, wherein said anode includes a hydrophilic proton conducting additive.

37. A method as in claim 7, wherein said methanol derivative is dimethoxymethane mixed with water to a concentration of about .1 to 2 M.

38. A method as in claim 7, wherein said methanol derivative includes dimethoxymethane, forming an electro chemical reaction of

$$(CH_3O)_2CH_2 + 4H_2O \rightarrow CO_2 + 16H^+ + 16e^-.$$

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39. A method as in claim 7, wherein said methanol derivative is trimethoxymethane mixed with water to a concentration of about .1 to 2 M.

40. A method as in claim 7, wherein said methanol derivative includes trimethoxymethane, forming an electro chemical reaction of

$$(CH_3O)_3CH + 5H_2O \quad 4CO_2 + 20H^+ + 20e^-.$$

41. A method as in claim 7, wherein said methanol derivative is trioxane mixed with water to a concentration of about .1 to 2 M.

42. A method as in claim 7, wherein said methanol derivative includes trioxane, forming an electro chemical reaction of

$$(CH_2O)_3 + 6H_2O \quad 3CO_2 + 12H^+ + 12e^-.$$

43. A method as in claim 7, wherein said methanol derivative is dimethoxymethane mixed with water to a concentration of about .1 to 2 M.

44. A method as in claim 7, wherein said methanol derivative includes dimethoxymethane, forming an electro chemical reaction of

$$(CH_3O)_2CH_2 + 4H_2O \quad CO_2 + 16H^+ + 16e^-.$$

45. A method as in claim 7, wherein said methanol derivative is trimethoxymethane mixed with water to a concentration of about .1 to 2 M.

46. A method as in claim 7, wherein said methanol derivative includes trimethoxymethane, forming an electro chemical reaction of

$$(CH_3O)_3CH + 5H_2O \quad 4CO_2 + 20H^+ + 20e^-.$$

47. A method as in claim 7, wherein said methanol derivative is trioxane mixed with water to a concentration of about .1 to 2 M.

48. A method as in claim 7, wherein said methanol derivative includes trioxane, forming an electro chemical reaction of

$$(CH_2O)_3 + 6H_2O \quad 3CO_2 + 12H^+ + 12e^-.$$

49. A fuel cell as in claim 65 wherein said additive is liquid Nafion™.

~~50~~. A method of oxidizing aqueous methanol in a fuel cell reaction, comprising:

receiving aqueous methanol at an anode;

oxidizing said aqueous methanol at the anode;

producing protons from the aqueous methanol oxidizing at the anode;

allowing the protons to cross a proton conducting membrane to a cathode and reducing a second component, at the cathode, using said protons which are produced at said anode.

51. A method as in claim 131, wherein said agent is Nafion™.